

Appn. Serial No. 10/039,045
Amendment Dated March 28, 2005
Reply to Office Action Mailed January 26, 2005

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions, and listings, of claims in the application:

1 1. – 2. (Cancelled)

1 3. (Currently Amended) The method of claim [[2]] 6, the step of asserting a lock signal
2 further comprising the step of:
3 asserting a split lock signal on the first bus, the split lock signal indicating that the lock
4 request contains two memory address data.

1 4. – 5. (Cancelled)

1 6. (Currently Amended) The method of claim 5, A method of controlling access to a shared
2 memory of a multiprocessor system, the multiprocessor system comprising a first bus and a
3 second bus coupled to the shared memory, the first bus coupled to a first processor, and the
4 second bus coupled to a second processor, the method comprising the steps of:
5 requesting exclusive access to a first memory location of the shared memory by the first
6 processor;
7 granting exclusive access to the first memory location of the shared memory to the first
8 processor;
9 allowing access to a second memory location of the shared memory to the second
10 processor while the first processor has exclusive access to the first memory location; and
11 storing access request information associated with the exclusive access in a first register
12 in a first memory controller and in a second register in a second memory controller,
13 the step of requesting exclusive access comprising the steps of:
14 asserting a lock signal on the first bus;
15 sending a lock request from the first processor to the first memory controller
16 coupled to the first bus, the second bus, and the shared memory;
17 forwarding the lock request from the first memory controller to a switch; and
18 signaling the first processor to retry the lock request.
19 the step of granting exclusive access comprising the steps of:

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20 signaling the first memory controller by the switch to retry the lock request;
21 assigning exclusive access to the first memory location by the switch;
22 notifying the first memory controller of the exclusive access assigned in the
23 assigning step; and
24 granting exclusive access to the first memory location by the first memory
25 controller responsive to a retry of the lock request by the first processor,
26 the step of assigning exclusive access to the first memory location by the switch
27 comprising the steps of:
28 determining if the first memory location is currently assigned;
29 saving the access request information in a register in the switch if the first
30 memory locations location is not currently assigned;
31 sending the access request information to the first memory controller; and
32 sending the access request information to the second memory controller.

1 7. (Currently Amended) The method of claim 6, the access request information comprising:
2 a node ID of the first processor;
3 a cycle ID of the first processor; and
4 memory address data for [[a]] the first memory location.

1 8. (Original) The method of claim 7, the memory address data comprising:
2 a first memory address; and
3 a second memory address,
4 wherein the first memory address can be non-contiguous with the second memory
5 address.

1 9. (Originally Amended) The method of claim [[1]] 6, further comprising the step of:
2 releasing exclusive access to the first memory location.

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1 10. (Previously Presented) A method of controlling access to memory of a multinodal
2 computer system, the multinodal computer system comprising a plurality of multiprocessor
3 nodes, the method comprising the steps of:

4 requesting exclusive access to a first memory location of a shared memory in a first
5 multiprocessor node of the plurality of multiprocessor nodes by a first processor of the first
6 multiprocessor node;

7 granting exclusive access to the first memory location of the shared memory to the first
8 processor;

9 allowing access to a second memory location of the shared memory to a second processor
10 of a second multiprocessor node of the plurality of multiprocessor nodes while the first processor
11 has exclusive access to the first memory location;

12 communicating between the multiprocessor nodes through a switch; and

13 sending, by the switch, access request information associated with the exclusive access of
14 the shared memory of the first multiprocessor node to the second multiprocessor node.

1 11. (Previously Presented) The method of claim 10, the requesting step comprising:
2 asserting a lock signal on a first bus, the first bus coupling the first processor and a first
3 memory controller of the first multiprocessor node; and
4 sending a lock request to the first memory controller;
5 forwarding the lock request from the first memory controller to the switch, the switch
6 coupled to each of the plurality of multiprocessor nodes.

1 12. (Previously Presented) The method of claim 11, the shared memory comprising:
2 a first memory coupled to the first memory controller; and
3 a second memory coupled to a second memory controller in the second multiprocessor
4 node of the plurality of multiprocessor nodes.

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- 1 13. (Original) The method of claim 12, the step of asserting a lock signal comprising the step
- 2 of:
 - 3 asserting a split lock signal on the first bus, the split lock signal indicating that the lock
 - 4 request contains a first memory address data and a second memory address data.
- 1 14. (Original) The method of claim 13, the first memory address data referencing the first
- 2 memory and the second memory address data referencing the second memory.
- 1 15. (Original) The method of claim 13, the first memory address data referencing the second
- 2 memory and the second memory address data referencing the first memory.
- 1 16. (Currently Amended) The method of claim 11, the step of requesting exclusive access
- 2 further comprising:
 - 3 ~~forwarding the lock request from the first memory controller to the switch; and~~
 - 4 signaling the first processor to retry the lock request.
- 1 17. (Currently Amended) The method of claim 11, the step of granting exclusive access
- 2 comprising the steps of:
 - 3 signaling the first memory controller to retry the lock request;
 - 4 assigning exclusive access to the first memory location by the switch;
 - 5 notifying the first memory controller of the exclusive access assigned in the assigning
 - 6 step; and
 - 7 assigning exclusive access to the first memory location by the first memory controller
 - 8 responsive to a retry of the lock request by the first processor.

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- 1 18. (Currently Amended) The method of claim 17, the step of assigning exclusive access to
- 2 the first memory location by the switch comprising the steps of:
 - 3 determining if the first memory location is currently assigned;
 - 4 saving the access request information associated with the exclusive access if the first
 - 5 memory location is not current assigned; and
 - 6 broadcasting the access request information to each memory controller of each of the
 - 7 plurality of multiprocessor nodes.
- 1 19. (Previously Presented) The method of claim 18, the access request information
- 2 comprising:
 - 3 a node ID of the first multiprocessor node;
 - 4 a cycle ID of the first processor; and
 - 5 a memory address data for the first memory location.
- 1 20. (Original) The method of claim 10, further comprising the step of:
 - 2 releasing exclusive access to the first memory location.
- 1 21. (Cancelled)

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1 22. (Previously Presented) A computer system for utilizing a shared memory, the computer
2 system comprising:
3 a first multiprocessor node, comprising:
4 a first processor bus;
5 a first processor, coupled to the first processor bus, the first processor comprising:
6 circuitry to generate an exclusive access request for a first memory
7 location,
8 a second processor bus;
9 a second processor, coupled to the second processor bus, the second processor
10 adapted to:
11 request access to a second memory location;
12 a first memory;
13 a first memory controller, coupled to the first processor bus, the second processor
14 bus, and the first memory, the first memory controller adapted to:
15 allow exclusive access to the first memory location by the first processor;
16 and
17 allow access to the second memory location by the second processor while
18 the first processor has exclusive access to the first memory location;
19 a second multiprocessor node, comprising:
20 a third processor bus;
21 a third processor, coupled to the third processor bus, the third processor adapted
22 to:
23 request access to a third memory location;
24 a second memory;
25 a second memory controller, coupled to the third processor bus, and the first
26 memory, the second memory controller adapted to:
27 allow exclusive access to the first memory location by the first processor;
28 allow access to the second memory location by the second processor while
29 the first processor has exclusive access to the first memory location; and

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30 allow access to the third memory location by the third processor while the
31 first processor has exclusive access to the first memory location; and
32 a switch, coupled to the first memory controller and the second memory
33 controller, for switching transactions between the first multiprocessor node and the second
34 multiprocessor node.

1 23. (Original) The computer system of claim 22, the first memory location comprising:
2 a first portion in the first memory; and
3 a second portion in the second memory.

1 24. (Original) The computer system of claim 22,
2 wherein the first memory location is in the first memory, and
3 wherein the second memory location is in the first memory.

1 25. (Original) The computer system of claim 22,
2 wherein the first memory location is in the first memory, and
3 wherein the third memory location is in the first memory.

1 26. (Original) The computer system of claim 22,
2 wherein the first memory location is in the second memory, and
3 wherein the third memory location is in the second memory.

1 27. (Original) The computer system of claim 22,
2 wherein the first memory location is in the second memory, and
3 wherein the third memory location is in the first memory.

1 28. (Original) The computer system of claim 22, the switch comprising:
2 a lock register for storing a lock control information.

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1 29. (Original) The computer system of claim 28, the lock control information comprising:
2 a node ID corresponding to the first processor;
3 a cycle ID corresponding to the first processor; and
4 a first memory address corresponding to the first memory location.

1 30. (Original) The computer system of claim 29, the lock control information further
2 comprising:
3 a second memory address corresponding to the first memory location.

1 31. (Previously Presented) The computer system of claim 29, the switch comprising:
2 circuitry to signal the first memory controller to retry allowing exclusive access to the
3 first memory location by the first processor;
4 circuitry to arbitrate among requests for exclusive access to the first memory location;
5 circuitry to broadcast the lock control information to the first memory controller and the
6 second memory controller.

1 32. (Original) The computer system of claim 31, the first memory controller further
2 comprising:
3 circuitry to signal the first processor to retry the exclusive access request;
4 circuitry to shadow the lock control information broadcast by the switch; and
5 the second memory controller further comprising:
6 circuitry to shadow the lock control information broadcast by the switch.

1 33. (Original) The computer system of claim 30, wherein the first memory address can be in
2 either the first memory or the second memory, and
3 wherein the second memory address can be in either the first memory or the second
4 memory.

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- 1 34. (Previously Presented) A method of controlling access to a shared memory of a
- 2 multiprocessor system, the multiprocessor system comprising a first bus and a second bus
- 3 coupled to the shared memory, the first bus coupled to a first processor, and the second bus
- 4 coupled to a second processor, the method comprising the steps of:
 - 5 requesting exclusive access to a first memory location of the shared memory by the first
 - 6 processor;
 - 7 granting exclusive access to the first memory location of the shared memory to the first
 - 8 processor;
 - 9 allowing access to a second memory location of the shared memory to the second
 - 10 processor while the first processor has exclusive access to the first memory location;
 - 11 wherein requesting exclusive access comprises:
 - 12 sending a lock request from the first processor to a first memory controller coupled to the
 - 13 shared memory;
 - 14 forwarding the lock request from the memory controller to a switch; and
 - 15 the switch broadcasting lock request information to the first memory controller and at
 - 16 least another memory controller.
- 1 35. (Previously Presented) The method of claim 34, further comprising:
 - 2 each of the first memory controller and at least another memory controller storing the
 - 3 lock request information.
- 1 36. (Currently Amended) The method of claim 35, further comprising the switch storing the
- 2 lock request information in a register in the switch,
- 3 wherein the memory controllers also store the switch lock request information in
- 4 respective registers in the memory controllers.
- 1 37. (Previously Presented) The method of claim 1, wherein the access request information in
- 2 the second register in the second memory controller is a shadow copy of the access request
- 3 information in the first register in the first memory controller.

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1 38. (Previously Presented) The method of claim 10, further comprising:
2 the switch forwarding the access request information to a second memory controller in
3 the second multiprocessor node; and
4 the second memory controller storing the access request information in the second
5 memory controller.

1 39. (Previously Presented) The method of claim 10, further comprising:
2 storing the access request information in a first register of a first memory controller in the
3 first multiprocessor node and in a second register in a second memory controller in the second
4 multiprocessor node.

1 40. (Previously Presented) The method of claim 39, further comprising storing the access
2 request information in a register in the switch,
3 wherein the access information in the first register of the first memory controller and in
4 the second register of the second memory controller are shadow copies of the access request
5 information in the register of the switch.

1 41. (Previously Presented) A multiprocessor system comprising:
2 a plurality of multiprocessor nodes, each of the multiprocessor nodes comprising:
3 a shared memory;
4 a processor to request exclusive access of a memory location in the shared
5 memory;
6 a memory controller to forward access request information associated with the
7 exclusive access from the multiprocessor node for storage of the access request information in
8 another multiprocessor node, the memory controller including a register; and
9 a switch coupled to the multiprocessor nodes, the switch to receive the access request
10 information and to send the access request information to the multiprocessor nodes for storage of
11 the access request information in the respective registers of the memory controllers.

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- 1 42. (Previously Presented) The multiprocessor system of claim 42, wherein the switch
- 2 includes a register to store the access request information,
- 3 wherein the access request information in the registers of the respective memory
- 4 controllers are shadow copies of the access request information in the register of the switch.